

Claims

1. An acoustic testing apparatus for testing a laminate material comprising at least one layer of a first material having a first velocity for a first vibration mode and at least one layer, adjacent to said first layer, of a second material having a velocity for a second vibration mode, approximately equal to said first velocity, said acoustic testing apparatus comprising:  
a first transducer for projecting an acoustic test signal onto a first layer of said at least one layer of a first material disposed in a testing zone, characterised by:  
a second transducer for receiving said test signal from said testing zone, and in that said first transducer is adapted to project said test signal at an angle so as to generate in said first layer vibrations of at least said first vibration mode, wherein said vibrations of said first vibration mode are incident on an interface with said layer of said second material under an incidence angle so as to produce in said second layer vibrations of at least said second vibration mode, so that refraction of said test signal at said interface is suppressed.
2. An acoustic testing apparatus according to claim 1, wherein said first transducer is adapted to project said test signal at an angle so that said vibrations of said first vibration mode predominate in said first layer.
3. An acoustic testing apparatus according to either claim 1 or claim 2, wherein said first transducer is adapted to project said test signal at an angle so as to suppress in said first layer the generation of vibrations of at least said second vibration mode.
4. An acoustic testing apparatus according to any preceding claim wherein said second transducer is arranged to receiving said test signal reflected from said testing zone.

5. An acoustic testing apparatus according to any preceding claim, wherein said second transducer is adapted to receive said reflected test signal at at least one location.
6. An acoustic testing apparatus according to any preceding claim, wherein data associated with said laminate material is directly derivable as a function of time and position from said reflected test signal received by said second transducer.
7. An acoustic testing apparatus according to any preceding claim, wherein at said interface said vibrations of said first vibration mode are converted to vibrations of said second vibration mode.
8. An acoustic testing apparatus according to any preceding claim, said vibrations of said first vibration mode are a shear wave and said vibrations of said second vibration mode are a compression wave, or vice versa.
9. An acoustic testing apparatus according to claim 6, wherein said angle corresponds to the angle of incidence of said test signal on said first layer measured with respect to the normal, and is between approximately 14 and 30 degrees.
10. An acoustic testing apparatus according to any preceding claim, wherein the frequency of said test signal is in excess of the order of 20 MHz.
11. An acoustic testing apparatus according to any preceding claim, further comprising a plurality of second transducers arranged in an array.

12. An acoustic testing apparatus according to any preceding claim, wherein said second transducer/s is/are arranged to be moveable to a plurality of locations for receiving said reflected test signal.

13. An acoustic testing apparatus according to any preceding claim, wherein said second transducer is rotatably mounted on a support.

14. An acoustic testing apparatus according to any preceding claim, wherein said first transducer is disposed on a surface of a solid element, wherein said surface is arranged so as to cause said first transducer to project said vibrations at said incidence angle.

15. An acoustic testing method for testing a laminate material comprising at least one layer of a first material having a first velocity for a first vibration mode and at least one layer, adjacent to said first layer, of a second material having a velocity for a second vibration mode, approximately equal to said first velocity, said acoustic testing method including the steps of: using a first transducer to project an acoustic test signal onto a first layer of said at least one layer of a first material disposed in a testing zone, characterised by:  
using a second transducer to receive said test signal reflected from said testing zone,  
and by adapting said first transducer to project said test signal at an angle so as to generate in said first layer vibrations of at least said first vibration mode, wherein said vibrations of said first vibration mode are incident on an interface with said layer of said second material under an incidence angle so as to produce in said second layer vibrations of at least said second vibration mode, so that refraction of said test signal at said interface is suppressed.